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DESCRIPTION OF THE PREPARATORY STAGES OF COENONYMPHA GALACTINUS, Boisduval.

BY W. H. EDWARDS, COALBURGH, WEST VA.

Egg.—Conical, broadly truncated, the flat top covered with a low network of irregular meshes, very fine about the micropyle; the lower part rounded, almost hemispherical; the upper part of side and to about two thirds the distance to base ribbed vertically,—about forty low ribs, with fine transverse lines between them; below the ribs there is an irregular network; color yellow-green. Duration of this stage about 13 days.

Young Larva.—At 24 hours from egg, length .1 inch; thickest at 2 and 3. Dorsum and sides sloping regularly to 13, ending in two short conical tails, which meet at base; color pale yellow-green, under side more yellow; a mid-dorsal brown line, and three such lines on the side, the lowest running with spiracles, the next near it, the third at a little greater distance from second and in fact, sub-dorsal; on each segment are white clubbed processes, each of which rises from a rounded brown tubercle; these form three rows on either side, one sub-dorsal, one mid-lateral, with a demi row between the two on three anterior segments; in these rows there is one process to the segment; the third row is at base, over feet and legs, two processes to each from 5 to 11, one each on 3, 4; on 2 and 12, 13, two hairs to each, in place of processes; these lower processes are smaller than elsewhere, and less bent, but are turned down; the upper rows are bent back, except on 2, there forward; feet and legs color of under side; head one half broader than 2, rounded, narrowing towards top, depressed at top; color pale pink; over the face are a few white tubercles with processes like those upon body, bent down. Duration of this stage 12 days.

After First Moult.—At 24 hours, length .19 inch; nearly same shape; color yellow-green; covered with fine, irregular white tubercles, each of which gives a very short hair, all except on 2 turned down and back; the

mid-dorsal line green; three green lines on side; the basal ridge yellow; head sub-globose, a little broader than 2, depressed at top; the surface much covered with fine white tubercles and short hairs; color green, darker than body. To next moult 7 days.

After Second Moult.—At 18 hours, length .32 inch; generally as at second stage; color more yellow, greenish-yellow, the tails reddish. To next moult 10 days.

After Third Moult.—At 24 hours, .56 inch; shape as at previous stage. Soon after this moult some of the larvæ gradually changed to buff and red, the others remaining green.

Mature Larva.—Length .84 to 1.06 inch; slender, scarcely arched dorsally, of even height and width from 3 to 7 or 8, then tapering gradually; ending in two short conical tails which meet at base, and are rough with tuberculations; whole upper surface of body covered thickly with fine sub-conical white tubercles, each of which gives out a fine short hair, so that the surface is downy; these hairs are either tapering, or clubbed, or cylindrical with round tips; color yellow-green striped longitudinally with yellow, there being two narrow, pale stripes near together on mid-side, and a heavier and deeper basal stripe; on mid-dorsum a dark green line edged by paler green than elsewhere; the tails tipped with red; under side, feet and legs bluish-green; head broader than 2, sub-globose, narrowing towards top, a little depressed at suture, finely granulated, and with a very short down; color greenish-yellow, the mandibles brown, the principal ocellus emerald in brown ring.

Or the body was reddish-buff, the stripes yellow; the tails red; under side red-brown; feet green, legs red-brown; head greenish-yellow, with a tint of brown. In one larva the sides stripes were nearly obliterated, leaving the side almost solid buff. From third moult to pupation about 12 days.

Chrysalis.—From green larva: length .36 inch; breadth at mesonotum .14, at abdomen .16 inch; shape of Satyrus *Alope*, the outline of ventral side more straight, the abdomen more swollen and less tapering; cylindrical, stout, the upper end truncated, the abdomen swollen, conical at extremity; head case narrow, ending in a sharp cross ridge which is a little arched at top, its sides excavated roundly; mesonotum prominent, arched, the carina rounded transversely, the sides slightly convex, followed by a shallow depression; color yellow-green, over dorsum and abdomen

finely specked with white; marked by nine black stripes of irregular length; of these there is one on dorsal edge of each wing case from base to inner angle of wing; a curved stripe on middle of each wing reaching the hind margin; a short stripe on the hind margin on ventral side of the curved stripe; two short parallel ventral stripes on antennæ cases, a longer one on ventral side between the wings; besides these there is an imperfectly colored narrow stripe on either side at posterior end; top of head case whitish with a dash of black below this on dorsal side.

From buff larva: color pinkish-brown, no black stripes, but the curved wing stripes appear in deeper brown, and along dorsal side of wing cases the same.

Another chrysalis from a buff larva was green, fully striped, but the wing cases were buff.

Another from buff larva was pinkish at first, with three darker stripes on dorsum, one on middle below the excavation, one short one on either side this, and all the stripes first described were also present, but were faint brown; this chrysalis in a day or two had changed to full green, with the nine black stripes, but lost the three additional ones.

Another was wholly green, no stripes at all. So that there is much variation in the number of these stripes, as well as in color of the chrysalis. Duration of this stage 11 and 12 days. Result wholly form CALIFORNICUS Bd.

GALACTINUS was described by Dr. Boisduval in 1852, together with *Californicus*. Of the latter he merely says: "It is found here and there in shaded places." Of the other: "Inhabits the mountains in the north, and appears to be rare." The two forms, as is seen from what I have stated above, are of one species, *Galactinus* being the winter, *Californicus* the summer form. It appears to be a common species near San Francisco. On 1st May, 1885, I received 13 eggs laid by *Galactinus* from Prof. J. J. Rivers, at Berkeley, and which were mailed 23rd April. Hatching began 5th May. On 7th, I received another lot, which began to hatch on 8th. By 11th, all had hatched. On 17th May, the first moult was passed by some of the larvæ; on 24th May, the second moult; on 3rd June, the third. The first pupation took place 15th June, and first butterfly came out 26th June. From laying of eggs to imago 65 days, the egg stage being 13, larval 41, chrysalis 11. The growth was rapid for a Satyrid, and in contrast with the tedious growth of Coen. *Ochracea*. The

larvæ feed on any species of lawn grass in confinement. I had grass in flower pot, covered by a muslin bag, and changed as it was eaten or lost its freshness. In all I brought seven larvæ to pupation, but at every stage had put one or two in alcohol. The number of moults was three, but probably the winter larvæ pass a fourth in spring, as does the larva of Coen. *Ampelos*. In general appearance the larvæ and chrysalids much resemble the genus Satyrus, but the processes on the young larvæ have nothing of the fish-bone character of *Alope*. The peculiar stripes on the chrysalis seem to be a generic character, as *Ampelos* and the European *C. Davus* (according to Mr. Wm. Buckler, Larvæ of British Butterflies, vol. 1, page 36, plate 6). But in *Davus* it is said that the pupa was light green at first, and "in a few days showed brown streaks on the edges and centre of the wing covers and at the tip of the tail." The figure on plate shows pale stripes to same extent and number as on *Galactinus*. The eggs are quite different from eggs of Satyrus, and still more unlike Neonympha, having a great number of ribs, which cover only the upper two thirds of sides.

NOTES ON THREE SMALL COLLECTIONS OF DIURNAL LEPIDOPTERA MADE DURING THE SUMMER OF 1886.

BY GAMBLE GEDDES, TORONTO.

The following species were taken by Capt. Gilpin Brown (late H. M. 92nd Regiment) in the Island of Newfoundland, during the months of July and August last:

1. Grapta Faunus, *Edw.*
2. Chrysophanus Florus, *Edw.* (or C. Helloides, *Boisd.*—uncertain.)
3. C. Epixanthe, *Bd.-Lec.*
4. Argynnis Atlantis, *Edw.*
5. Melitæa Harrisii, *Scud.*
6. Phyciodes Tharos, *Drury.*
7. Colias Interior, *Scud.*
8. *ib. var.* Laurentina, *Scud.*
9. Cœnonympha Inornata, *Edw.*

Strange to say, no specimens of *Lycæna Couperii* or *Papilio Brevicauda* were seen, though possibly it was too late in the season for both species.

The variety *Laurentina* of *Colias*, found by Captain Brown, is interesting from the fact that it is the identical species from which Mr. Scudder made his descriptions and observations in 1876. It has a very distinct appearance, being much rounder in the outline of its wings—whether open or closed—than any of the species of *Colias* with which I am familiar.

It is interesting also to find *Cænonympha Inornata* in Newfoundland; this species is quite different from the *C. inornata*, so named by Mr. W. H. Edwards, from the prairies of our North-west. The difference is so marked that I am inclined to think that the butterfly that is so common in the North-west is *C. Ochracea*, Edw., and that *Inornata* proper does not occur there. This conclusion is arrived at after consulting abundant material, over one hundred specimens having been examined.

II. At Lake Superior, in the neighborhood of the Kaministiquia River, I took the following species:

1. Grapta Progne, *Cram.*
2. Colias Edwardsii, *Behr.* ♂.
3. " Interior, *Scud.*
4. " Philodice, *Godt.* ♀
5. " Hagenii, *Edw.*
6. " Eurytheme, *Boisd.* (seen in numbers, but not taken).
7. Pieris Virginiensis, *Edw.*
8. Argynnis Bellona, *Fab.*
9. " Chariclea, *Schneid.*—quite common.
10. " Atlantis, *Edw.*
11. " Myrina, *Cram.*

These lists are published for the sake of the localities, as I believe there is no authenticated report of the appearance of *Colias Edwardsii* so far east, or of *C. Hagenii;* also *Argynnis Chariclea*, or *A. Boisduvalii*, which I have found at a high altitude in the Rocky Mountains, but not so far south and east as Port Arthur, on Lake Superior.

III. A small collection of butterflies was made last summer in the Hudson Bay Straits by Mr. Frank Fitz Payne, of the Toronto Observatory, who accompanied Lieut. Gordon's expedition on the "Alert" to the Arctic Regions. The specimens were kindly identified by Mr. W. H. Edwards,

of Coalburgh, West Va. They can be easily referred to at any time in my collection.

Although Mr. Payne devoted much of his time to the collection of insects, I regret to say that nothing absolutely new to our present list of diurnals of N. America has come to hand. With the exception of one curious green ♀ of *Colias Hecla*, Lef., Mr. Edwards had seen all the species before. As this ♀ was the only one out of many that had this peculiar appearance, it may perhaps turn out to be something new—there being a great similarity between all the others.

The *Chionobas* vary greatly in size and appearance of apparently the same species—*Chionobas Taygeta* and *Chionobas Crambis* particularly. In *Chionobas Semidea* the shades of gray in some are quite light in color, and in others run almost into black.

The following is a complete list of the butterflies taken :

1. Colias Hecla, *Lef.*
2. " Nastes, *Bd.*
3. Argynnis Polaris, *Bd.*
4. " Freya, *Thunb.*
5. Chionobas Semidea, *Say.*
6. " Crambis, *Frey*
7. " Taygeta, *Hüb.*
8. Lycæna Aquilo, *Bd.*

I hope at no distant date to be able to give a list of the moths, and as far as possible of the Hymenoptera and Diptera. Strange to say, no Coleoptera were seen at all.

CORRECTIONS TO MY PAPER IN JULY NO. OF CANADIAN ENTOMOLOGIST.

BY A. R. GROTE, A. M., BREMEN, GERMANY.

On pages 121-122 the generic term *Lepisesia* is twice written wrongly, "*Lipisesia.*" To my statement with regard to the food plants of the *Smerinthinæ*, must be added that several unocellated genera feed on forest trees, such as poplar, linden, oak, etc. I have taken our *geminatus* on willow; my statement as to fruit trees *(Rosaceæ, Caryæ)* gives the

general food of *Cressonia*, *Calasymbolus*, *Smerinthus* and *Paonias*. I would likewise add to my remarks as to the sequence of the groups that they seem to me to form two series; the first embracing the *Macroglossinæ*, *Chærocampinæ* and *Smerinthinæ;* the second the *Acherontinæ* and *Sphinginæ;* the members of each series resembling each other more than the members of the opposed series. With regard to my List, p. 126 et seq., I would say that the manuscript was in the main long completed, perhaps nearly a year before I received Prof. Fernald's excellent paper. After receiving it I merely so far corrected and added to my MSS. This accounts for the resemblances between my paper on page 121 and my preface to the List, in both of which I bring out the same points with regard to the groups. In the List itself "*Noctuiformis* ‡ H.-Sch.," should be cited in the synonymy of *Cautethia Grotei* Hy. Ed. It has been shown that the Cuban and Floridian species are the same, but Walker's *Noctuiformis* from St. Domingo is a different species. I only accidentally saw the description of *S. Separatus;* and possibly some species described within the last three years has escaped me during my absence from home.

Oct. 23, 1886.

NOTES ON ABNORMAL TYPES OF THE LARVA OF SMERINTHUS MYOPS.

BY ROBERT BUNKER, ROCHESTER, N. Y.

For three years past I have reared this species from eggs and young worms, and in no instance have they agreed with descriptions I have met with. Two years ago I had a brood of eight. Three of them had six spots—three on each side—two four spots, one two spots, and two without spots.

Last year I had nine, not one of which had the least semblance of a spot, and were lighter green than those of the year before. This year the brood consisted of seven, two of which were unspotted, one with four, three with two, and one with a single spot.

Where there were but two spots they were invariably on the third segment. In case of four spots on the third and seventh. When six occurred the intermediate ones occupied the fifth segment. The unique

that claimed but one spot was polite enough to carry the *insignia of rank* on the right side of the third segment.

The immaculate specimens were destitute of oblique lines on the sides, or at least the lines were so faint they could scarcely be seen.

The two broods produced fine specimens. The third has entered the ground, and no doubt will appear in their rich dark brown dress next spring. Smith and Abbott describe the spots as reddish brown; other writers as rust red. My specimens were bright crimson or cardinal red. Stigmatal spots olive green.

It will be seen from the foregoing that the larva of *Myops* is exceedingly variable; but that out of twenty-four specimens not an individual answered to the description given by authors is remarkable.

A NEW NOXIOUS CAPSID.

BY P. R. UHLER, BALTIMORE, MD.

Lygus monachus, n. sp.

Long oval, pale green or testaceous, coarsely punctate above, sericeous pubescent. Face convex, highly polished, bald; base of vertex with a longitudinal impressed line, towards which a similar line runs obliquely forward each side from the inner corner of the eye; antennæ sparsely and minutely pubescent; basal joint thickest, a little longer than the head, tapering at base; second joint thrice as long as the basal, infuscated, and a little enlarged towards the tip; third and fourth setaceous, both together not as long as the second. Pronotum highly polished, convex, coarsely punctate in transverse wavy lines, each side with a dark brown vitta, or long spot; lateral margins smooth, callous at base, the humeral angles subacute; callosities prominent, convex, almost confluent on the middle; lateral flap of pronotum irregularly punctate. Pectoral pieces pale, impunctate. Legs pale green, feebly pubescent; apex of posterior femur usually with one or two fuscous bands, tip of tarsi and the nails black. Scutellum moderately convex, excavated at base, transversely obselete, punctate, more or less infuscated. Corium coarsely transversely vastrate-punctate, the clavus more or less infuscated, sometimes with all but the margins covered with dark brown; corium usually with a trans-

verse dark brown arc next the posterior border; cuneus long and wide, the incised base fuscous and the inner margin brown; membrane pale testaceous, with two or more dark clouded spots, the inner submargin of the principal areole, a spot at its tip and the base next the cuneus all more or less fuscous. Ventor pale greenish.

Length of body, ♀ 5 millims.; to tip of wing covers 7 millims.; width of pronotum, 2 millims. ♂. Length of body, 4 millims.; to tip of wing covers 5½ millims.; width of pronotum, 1¾ millims.

This has proved to be a very common insect in various localities.

Mr. Cassino collected numerous specimens around Peabody, Mass. Mr. Bolter sent to me a pair from Illinois and Missouri, and I have taken it from Alders, Maples and many other kinds of small trees and shrubs on Cape Ann, Mass., also near the base of the White Mountains in New Hampshire, and near Quebec, Canada.

Mr. Forbes has also forwarded to me specimens from near Normal, Ill. It resembles *Lygus invitus*, Say., and presents several of the color varieties common to that species, but it is a much larger insect, of a longer figure, and has a more flattened upper surface.

OCCURRENCE OF THE CHINCH-BUG (BLISSUS LEUCOPTERUS, SAY) AT BUFFALO, N. Y.

BY E. P. VAN DUZEE.

This pernicious insect has been very abundant here for many years. As early as 1874 I found it in considerable numbers among moss on dry, grassy hill-sides at Lancaster, N. Y. This season (1886) it was remarkably abundant in a dry upland hay field near the same locality. I have also taken it at Ridgeway, Ont. Ordinarily the short winged form predominates, but in hot, dry summers, such as those of 1881 and 1886, they mostly acquire fully developed membranes. I find on comparison with a lot of perhaps one hundred fully developed examples from Kansas, that ours are quite uniformly larger and more robust, with longer hairs on the pronotum.

Prof. J. A. Lintner says *(2nd Annual Report N. Y. State Ent., page 150)* that, previous to its appearance in St. Lawrence county in 1882, the only recorded occurrence of this insect in New York State is that mentioned by Dr. Fitch *(2nd Report, 1856, p. 287)*. From this it appears that it has not been recorded, if indeed it occurs generally in this State. Its early introduction at this locality is only natural, considering the immense grain traffic which yearly passes through this city direct from the infected States of the West, on its way to the seaboard; yet it does seem strange that its first appearance in sufficient numbers to attract general attention should have been in Northern New York, quite aside from any of the main lines of transportation, unless, as Prof. Riley suggests *(Science, vol. II., p. 621)*, it be a native species, which, through an unusual series of favoring circumstances, has increased enormously in certain localities. That it has not been reported as an injurious insect in this locality seems to me no proof that it has not been injurious. To be sure, it has not appeared in such overwhelming numbers as to force itself upon public notice as in other places, but from my own observations I think that no inconsiderable part of the injury to hay fields charged to the dry weather is in reality the work of this insect, or rather the combined effect of the two. For example, the hay field at Lancaster mentioned above, which last year yielded an abundant crop, is literally ruined and will have to be plowed under in the spring, while other fields less protected, where the bug was not found in numbers, escaped injury; and I know of several other fields near this city apparently affected in the same manner.

I have always found this insect in hay fields, generally in timothy or clover, occasionally among wild grasses. I do not recollect ever having taken a specimen in a grain field of any kind. If it has so thoroughly acquired the habit of subsisting upon the cultivated cereals in the West, why should it not affect the same plants here, especially if it has been introduced from that section of the country through commercial transportation? It would be highly interesting to learn of its occurrence in this State at localities distant from main railroad lines.

LIST OF ORTHOPTERA TAKEN IN THE VICINITY OF MONTREAL, P. Q.

BY F. B. CAULFIELD.

BLATTIDÆ.

*Stylopyga orientalis, *Linn.* Common in houses; have also taken it under stones in a lane behind a bakery in summer.

Ischnoptera pennsylvanica, *De Geer.* Not common. I took a specimen under bark of a stump on Montreal Mountain some years since, and on June 4th, 1885, I took three specimens under bark of a stump at Abbotsford, P. Q.

Temnopteryx marginata. Rare. Two specimens taken under bark of a fallen tree on Montreal Mountain.

*Ectobia Germanica, *Stephens.* Common in houses in the city of Montreal. Has been so to my knowledge for the last fifteen years; how much longer I cannot say.

PHASMIDÆ.

*Diapheromera femorata, *Say.* Common at Montreal.

GRYLLIDÆ.

Gryllus neglectus? *Scudd.* Abundant. Specimens in the larval stage may be found under stones as soon as the snow has melted. Have passed through their moults by the end of May, when they may be heard "shrilling." Have not heard them during July. Again heard beginning of August and from that to end of the season. Several heard shrilling October 30th, 1886.

Gryllus luctuosus, *Serv.* Very rare; only two specimens taken.

Gryllus domesticus, *Linn.* Common in bake-houses.

Nemobius vittatus? *Harr.* Abundant. Its song commences about the first of August and lasts until the end of season; heard shrilling October 30th, 1886.

Nemobius fasciatus *De Geer.* Not so common as last species.

Œcanthus niveus, *Serv.* Very common; season from about the first of August to about the middle of October.

LOCUSTIDÆ.

Ceuthophilus maculosus, *Harr.* Common under stones and bark of dead trees in damp situations.
Amblyconypha oblongifolia, *Harr.* Not common.
Phaneroptera curvicauda, *Serv.* Not uncommon.
*Xiphidium fasciatum, *Serv.* Common in damp fields.
Xiphidium brevipennis, *Scudd.* Common in same localities as last species.
Orchelimum agile, *De Geer.* Common in tufts of herbage in damp places.

ACRIDIDÆ.

Stenobothrus curtipennis, *Harr.* Very common in fields during latter part of summer and fall.
*Tragocephala infuscata, *Harr.* Common during spring and early summer; *var.* viridifasciata, not so common.
Melanoplus femur-rubrum, *Burm.* Very common during the end of summer and fall.
Melanoplus femoratus, *Burm.* Common during latter part of summer.
Dissostria carolina, *Burm.* Abundant during latter part of summer.
Œdipoda verruculata, *Scud.* Not uncommon.
*Œdipoda phœnicoptera, *Germ.* Very rare, one specimen taken on Montreal Mountain, some years since.
Eucoptolophus sordidus, *Burm.* Not uncommon in dry fields during the latter part of summer; flies with a rustling sound like Tragocephala.
Camnula pellucida, *Scudder.* Abundant; appears about the middle of June and lasts until September.
Tettix granulata, *Kirby.* Common.
Tettix triangularis, *Scudder.* Not uncommon.
Tettigidea polymorpha, *Burm.* Very common.
Tettigidea lateralis, *Say.* Very common.

I have taken the four latter species in early spring as soon as the snow was off the ground. With the exception of those marked with an *, the species in the above list were kindly named for me by Mr. Scudder. The Gryllides were also submitted to him, with the exception of *luctuosus* and *domesticus*, but he wrote me that he was unwilling to say what they were until he could take time to study them.

ON THE GEOGRAPHICAL DISTRIBUTION OF NORTH AMERICAN LEPIDOPTERA.

BY AUG. R. GROTE, A. M.

(Continued.)

Again, the genera *Citheronia* and *Eacles* are a South American element in our fauna, while the typical Attacinæ, such as *Actias*, probably belong to the Old World element in our fauna, together with all our *Platypteryginæ*. Among the Hawk Moths the genera *Philampelus* and *Phlegethontius* are of probable South American extraction, though represented now by certain strictly North American species. Mr. Robert Bunker, writing from Rochester, N. Y., records the fact that *Philampelus Pandorus*, going into chrysalis August 1, came out Sept. 10 as a moth, showing that in a warmer climate the species would become double-brooded. And this is undoubtedly the case with many species the farther we go South, where insect activities are not interrupted so long and so strictly by the cold of winter. Since the continuance of the pupal condition is influenced by cold, a diminishing seasonal temperature for ages may have originally affected, if not induced, the transformations of insects as a whole. Butterflies and Moths which are single brooded in the North become double brooded in the South. The winter is the season during which the activities of insects cease and the existence of Lepidoptera becomes artificially lengthened by the intervening of the cold. Premature hibernation is a relic of the time when the winters were longer than at present; this habit is seen in the case of the larvæ of several species of Butterflies, and is otherwise inexplicable. Again, the Notodontid genus *Apatelodes* is of a Southern type of this Sub-family of the Spinners, while *Datana* is descended ultimately from Tertiary Arctic forms. In these two cases the genera have probably gradually become distinct from their allies; nevertheless the relationship to existing genera in South America and Europe may be plainly traced. The foreign elements in our Moth-fauna overlap those which may be considered North American *per se*.

From studies of this nature, here briefly summarized and but partially displayed, the Science of Entomology derives an importance not discernable when it is limited to a mere sorting of species classified after their variety and their value according to the collection. It is part of the task

which the intellect perceives to await accomplishment after a mass of work has been performed in recognising the different kinds. It is hardly advanced by the use of difficult language and the employment of abstruse terms; for my own part I have always tried to use plain English in the proportion as I seemed really to understand the subject I had in hand, and, without in any way undervaluing the use of proper scientific terms, I think that writings on our Butterflies and Moths are occasionally overloaded with them, to the detriment of the clear understanding of the subject. We are here facing the one simple problem of the ancestry of our present species and in explaining the existence of the different elements in our fauna, and in trying to sort a few of our leading genera, I have aimed at making the subject clear and attractive, if I could, rather than at expressing myself in a simply technical manner. After the first passion for possessing rare or fine specimens has become blunted, the deeper problems connected with these beautiful and interesting insects obtain a hold on the mind, exercising a more controlling fascination as they lead to wider results. I have been especially struck with the fact that so many leading genera, e.g., *Catocala*, do not cross the Equator, being confined to the Northern Hemisphere, as also that there is perhaps, on the whole, between the different faunæ, from East to West, a greater general resemblance than from North to South. The hot central Equatorial Region evidently precludes the passage of certain genera, notwithstanding its fecundity in peculiar forms. And notwithstanding physical barriers, such as oceans and mountains, there seems to have been a transference through changes in climate on isothermal lines around the globe. All these matters are very interesting to speculate upon, and the common mistake of setting up an hypothesis and then treating it five minutes afterwards as a fact as old and well established as the hills, I have myself often, no doubt, fallen into. But I have always relied on my friends to correct my mistakes in print, a matter they have ever promptly attended to, so that, in some sense, I feel quite secure in my statements, which, if they are likely to be true, will be "absorbed," and, if they are not, will be "corrected," myself abused and the public disabused by the operation.

The subject of geographical distribution is, as I have said, best studied in connection with the topography of the country. In this connection the two principal drainages of the country, the Mississippi and its tributaries, and the chain of the Great Lakes and the St. Lawrence, must be taken into consideration. Valleys and water courses have attracted and furthered

the propagation of animals, and assisted the development of the civilization of man. In America we have evidence of the former existence of human societies along the Ohio River, and to whatever branch of historical studies we may betake ourselves, the topography of the country must supply the foundations and become fixed in our minds. It is the scaffolding upon which is displayed the picture of animated Nature. After the physical features, the prevailing winds, the amount of rainfall, the *average* warmth must be observed. Early in my studies I became interested in the migrations of the Lepidoptera in North America. A yearly zoological wave sets in from the tropics and carries upon its crest numbers of light-winged Moths, which eventually range up our entire coast, and are found in Maine in the autumn. The summer, that pulse of the year, the length of whose recurring beat is at once the measure of the time elapsed since the culmination of the last ice period, gives us a prevailing northward direction for the winds that sweep the North American continent. They offer aerial paths along which numbers of feathery winged moths are hurried. They distinctly aid the dispersal of the Cotton Moth, for instance, and on the coast of Georgia it comes earlier or later as the south wind has blown fitfully or steadily. We have wind visitors on our shores during the whole season, some of which become citizens for a time by breeding intermittently within our territory.

All natural barriers succeed to some extent in producing more or less local variation in flora and fauna, and local variation ends, in connection with the climate, in producing distinct species. The species of moths inhabiting islands, or confined between mountain chains, often show distinctive features in color, size and markings. From what I have seen I think that *Thyatira Pudens*,* found on Anticosti, has become grayer, the pink spots less vivid than on the main land; the darkening by mixing of color, noticeable in Polar species, has here taken place. Many other instances occur to me in writing, but it is sufficient here to refer to local variation as affording an interesting part of the study of *Lepidoptera*. After a certain phase of variation has been attained it seems probable that interbreeding stops, and that, were the original form introduced, it would continue breeding side by side and without intermingling with the

* This variety is worthy of a distinct name, and in my second Check List of N. Am. Noct. (MSS.) I have called it *Anticostiensis*. The moth is grayer, more hoary, the pink color has faded. Mr. Wm. Couper has taken this form on the island.

local form, until finally succumbing to the same influences. A good deal of what we are now warranted in assuming, is merely reasonable conjecture in default of experiment, but more and more facts are becoming known, all tending to throw light on the origin of species, and in this progress the study of Butterflies and Moths has proved of the greatest assistance to naturalists and philosophers.

As a special illustration of the study of the probable origin of our North American fauna I may attempt a brief discussion of the genera of our Hawk Moths, and present some tables of the different categories. We have seen that there are three proximate sources for our fauna. 1, Descendants of an Arctic Tertiary fauna. This fauna was forced southward and apart by the last Glacial Epoch, the species descending into Central Asia, Southern Europe, and the American tropical and subtropical region. This category includes species now identical in Europe and America, and which have not been introduced by commerce in historical times, while these latter form a distinct sub-category. 2, Descendants of the North American Tertiary fauna, the members of which latter occupied about the same limits that their descendants do to-day, probably they ranged further to the North. 3, Descendants of an immigration from the South. This stream is still of yearly occurrence. A colony, as we have seen, has been planted in South Florida from the West Indies and South America. Probably also, on the decline of the Ice Period, certain species of South American origin settled permanently and became modified by their residence in the regained territory. This category includes forms permanently domiciled and also such as visit us merely during the summer and do not survive the winter. As belonging to the first category in the Sphingidæ we have the genus *Hemaris*, which in Europe has only two species, but with us from 12 to 15. (The series *Tenuis*, *Diffinis*, *Marginalis* and *Axillaris*, ranging from Canada to Texas, have probably the same origin as the European *Fuciformis*. And we have a distinct sub-genus, *Haemorrhagia*, which contains at least two distinct species, *Thysbe* and *Fuscicaudis*. If we are to believe Mr. Hulst, *Uniformis* is a dimorphic form of *Thysbe*, differing, as I pointed out, by the evenness of the inner edge of the terminal band of primaries. Now the typical series of four species of *Hemaris*, above mentioned, differ from each other in much the same way. In *Tenuis* the band is narrowest, tapering to anal angle, being *even* inwardly and the usual red apical spot wanting, or at

best only the faintest indication. In *Diffinis* the spot is distinct and the inner edge is very slightly *uneven*. In *Marginalis* the inner edge is regularly dentate on the interspaces. In *Axillaris* the dentations are irregular, some very deep and long, while the red spot has become almost a band, extending over the inferior interspaces. In *Haemorrhagia* the body proportions are slightly modified and the band is all claret red. In *Thysbe* the inner edge of the band is dentate. In *Uniformis* it is even. I have described and figured both sexes of *Buffaloensis*, a smaller form agreeing with *Uniformis* by the evenness of the band, while the cell is so filled in as to obscure the bar inferiorly. Now if *Buffaloensis* is only a starved or small *Uniformis*, why do we not find starved or small *Thysbe* with the band dentate? Similarly if *Floridensis* is a stuffed or large *Uniformis*, why is the shape of the band itself modified? Clearly we do not as yet know everything about these insects. We must experiment and breed them, without prejudice or desire to make more or less species than there really are. Mr. Lintner has, I believe, described the larva of *Buffaloensis*. We must not expect very great differences in the larvæ of these forms, but if they differ from each other and breed true, then they are good species. Mr. Hulst says *Thysbe* does not breed true, but occasionally produces *Uniformis*, and this we must accordingly accept. But it is not shown that *Buffaloensis* or *Floridensis* are so produced, or that Mr. Hulst knows these forms. I would recommend him to read and study our original papers and figures, which, of *Buffaloensis*, are very excellent, but, if I recollect right, the artist made a mistake in color in the abdomen of *Floridensis*.) Our next genus to *Hemaris* falls into our third category. The species of *Aellopos* are of South American origin. Our next Eastern genus, *Lepisesia*, is probably of North American origin and falls into the second category, but as to this I need further studies of the allied European *Pterogon Œnotheræ*. But the following genera are decidedly North American in their origin, *Amphion*, *Thyreus* and *Deidamia*, while *Enyo* is again South American. The two Californian genera, *Euproserpinus* and *Arctonotus*, are, the first allied to the European *Macroglossum Stellatarum*, while the second is *sui generis* and decidedly American. There remains, in this sub-family, the genus *Cautethia* to examine. This is undoubtedly South or Central American in its origin. The moth *Cautethia Grotei* is found in Florida and also in Cuba; thus it is a member of the Florida colony of which I have spoken, while the two other species, *Noc-*

tuiformis and *Spuria*, are found in Saint Domingo and Mexico respectively Dr. Herrich-Schaeffer mistakenly identifies the Cuban species *Grotei* of Mr. Edwards, with Walker's *Noctuiformis*, and in my papers on the Cuban Hawk Moths I followed him. In the second sub-family, the *Chærocampini*, we have the genus *Deilephila* decidedly belonging to our first category. Here the position of *Hemaris* is reversed. We have but two species of *Deilephila* in America, representing the *Galii* and *Livornica* of Europe; while, in Europe, a number of species have descended from the common Tertiary progenitor of both the American and European forms. The remaining genera, except *Everyx*, are decidedly South American in character. Our two more Northern common forms of *Philampelus* have long been settled in our territory. *Pachylia* and *Argens* are South American, even as to species, the latter being a summer bird of passage. In the *Smerinthini* we have, as a whole, descendants from an Arctic Tertiary fauna, but certain of the forms probably are strictly belonging to our second category, such as *Cressonia* and *Paonias*. *Smerinthus* proper is only Californian, and *Calasymbolus* has probably an Asiatic species, *Kindermanii*, which I have never seen. *Triptogon* is decidedly a descendant of an Arctic Tertiary genus, which in Asia is represented by many species. The fourth group of the *Sphingidæ* is not represented in North America. *Acherontia* is probably descended from Tertiary Old World ancestors which equally probably never occurred in North America. The fifth group, the *Sphingini*, is interesting from the mixture of genera of different origin. While the *Smerinthini* do not seem to cross the Equator, in the New World at least, the *Sphinginæ* are widely spread, so that their origin is an interesting study. The forms of purely North American descent and belonging to our second category, are *Ceratomia*, *Dolba*, *Ellema* and *Exedrium*, genera with single peculiar species, if we except *Ellema*, which, with its unspotted abdomen, contains three doubtfully distinct species and is not unlikely derived from *Hyloicus*. I cannot believe we have to do with an aberrant Smerinthoid form, notwithstanding what Prof. Fernald seems to think about it. The genus *Sphinx* deserves careful study. It seems to me that the European *Sphinx ligustri* is a true *Sphinx*, and in this regard our species depart a little from the type and are numerous, while in Europe there is only one, the European *Convolvuli* being, in my opinion, referable to *Phlegethontius*. But this latter genus is decidedly South American in its character, and to

this category I would refer the remaining genera, *Diludia*, *Amphonyx* (a Florida colonist) and *Dilophonota*, while *Hyloicus* belongs to the first category. *Daremma*, with its three species, *Undulosa*, *Catalpæ* and *Hagenii*, may be rather strictly North American. Its nearest ally is the tropical *Syzygia Afflicta* (Cuba) and *Pamphilius* (Surinam). The rough, mixed gray, sometimes greenish, stout *Sphingidæ* belonging to the genera *Diludia*, *Syzygia* and *Daremma* (as also *Macrosila tetrio*) are South American and tropical in their general character. They approach *Phlegethontius* in structure and ornamentation, and the series culminates in the gigantic species belonging to Poey's very distinct genus, *Amphonyx*.

When we study the Canadian fauna we see that the South American forms tend to become rarer and drop out, whereas the forms of European affinity and strictly North American in character, persist. The condition of our present knowledge warrants the hope that we shall before long attain complete information as to the range of our Hawk Moths, and, by the aid of strict, unprejudiced studies of their structure, comparative with the South American and European forms, arrive at nearly exact conclusions as to the origin and progress of this most interesting family of Moths.

The conclusions, though entirely preliminary and tentative, which I have reached, as above, concerning our *Sphingidæ*, and which in detail I am willing to correct from further evidence, show us at least how deep-reaching the study of the origin of our fauna is, and what vast questions attend the subject of Geographical Distribution. It cannot be doubted that the study of our fauna, pursued in this way, gains in importance. The small links in the chain of eternal causation must be delicately handled and much must remain a matter of opinion, but always of *intelligent* opinion. Dogmatism is ridiculously out of place in all scientific studies, and nowhere is it more absurdly useless than in dealing with Butterflies and Moths, these frail structures which have hardly left an impression behind for all the æons they have flitted about this globe. Sipping the honey from the flower-cups, they have found their sudden grave most often in the stomach of some insectivorous vertebrate, and this may in one way account for the few fossils we find of them. But a variety of causes contribute to this result, and the imperfection of the geological or palaeontological record with regard to the Lepidoptera, entirely prevents our making tables of descent, such as have been prepared for so many of

the vertebrates by modern science. We are thrown for our surmises upon the structure of existing forms, and this very alluring study I have endeavored to give a sketch of in the present chapter. I repeat what I have often said, that only by such views of the Lepidoptera, such higher uses to which we may put our knowledge and observations, do we relieve the study from the charge of triviality, a mere sorting and arranging of objects which is pursued by some even to the elimination of æsthetic amusement and pleasure, and degenerates into a mere storing up of specimens rare and difficult to obtain, and panders to the strictly selfish passions of the human heart.

(To be Continued.)

NOTE ON AGROTIS HOSPITALIS.

BY A. R. GROTE.

Having recently, through the kindness of Mr. W. W. Hill, the well known Lepidopterist, been able to carefully compare my type of *hospitalis* with a series of *Agrotis perconflua* Gr., I believe we have to do with a variety of this latter species differing by the black marked t. a. line, the black edging on costal region of t. p. line, the more suffused and deeper color. The insects are structurally identical, and although variation in these points is not usual (I have not met with it), yet the perfect correspondences in other points carry the conviction that in *hospitalis* from Lewis Co., N. Y., we have only a form of *perconflua*. These more northern forms of the genus, viz., *Hilliana*, *conflua*, *perconflua*, and *rubifera*, are related to our common New York species, *A. Phyllophora*, and the Californian *A. Rosaria*, as well as to several European species of the genus *Agrotis*.